Interrogative City Infrastructures

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***Abstract*—The term City Infrastructures is restricted often to the physical elements of a city, while in practice it represents both hard infrastructure of built environment and utilities, as well as soft infrastructures comprising services, networks, social groupings, and personal skills. Part of the confusion is the lack of clarity about the role and delivery of infrastructure and its relationship to livelihood and livability. To address this issue, a critical examination was undertaken of urban sustainability from perspectives of City Infrastructures using an interdisciplinary framework that investigates the relationships, conflicts and connections between soft and hard infrastructures in terms of utilities, institutions, communities and personal skills.**

Keywords-component; soft and hard infrastructures, interrogative infrastructures, collaborative urbanism, livelihood and livability, urban governance

I. INTRODUCTION

The design, construction and maintenance of the physical fabric of cities is largely undertaken by town planners, architects and engineers based on their professional judgement with often minimal input from the people living and working in these urban spaces. This detached relationship between the professional expert and the citizen as a primary user is further complicated by the scarcity of objective scientific research into how city infrastructures actually perform and in particular meets the needs of users. This situation is due in part because design practice and scientific research occupy 'two very different worlds' where design is more intuition led rather than evidence based on tools such as post occupancy evaluation whereas the cornerstone of scientific research is objectivity [1, 2]

At the same time, the term City Infrastructures is often restricted to the physical elements of a city, whilst in practice it comprises the rich ecology of utilities, services, networks, social groupings, and personal skills. Furthermore decision making about urban development is not a level playing field with many citizens and communities denied meaningful access to decision making. Part of the reason is the lack of clarity about the role and delivery of infrastructure, and the relationship to livelihood and liveability.

To deal with these shortcomings, a framework for Collaborative Urbanism based on City Infrastructures has been developed to explore the symbiotic relationship between hard and soft infrastructure. The methodology is geared towards enabling citizen engagement through cultivating open processes of urban exploration, and advocating the need for 'connected infrastructures' thinking [as opposed to disconnected infrastructures]. As such it aims to create the capacity among citizen and stakeholder groups to critique infrastructural provision and participate in strategic design thinking about how urban qualities are under-pinned by connected infrastructures, can strengthen resilience and increase sustainable governance as we face an uncertain global future.

II. CITY INFRASTRUCTURES

A. Cities as Complex Systems

By their very nature, cities are complex systems. Back in the early sixties, Jane Jacobs referred to cities as "Organisms that are replete with unexamined, but obviously intricately interconnected, and surely understandable relationships" [3]. Furthermore, Vale and Vale [4] describe the city as dynamic interactive systems that demand systems thinking to unpick the many challenges. Likewise, the systems approach has informed the work of Newman and Jennings [5] who promoted the 'Cities as Sustainable Ecosystems'. This approach, which focuses on relationships and processes, gives a better insight into emergence and complexity; while also acknowledging the importance of context where "Ecosystems are nested, as we are nested within ecosystems – systems within systems, wholes within wholes". As such it can be argued that cities will be more sustainable if they reflect the ecological principles that operate within natural systems.

In light of the challenges facing the creation of sustainable urban ecosystems, urban spatial planning has come under pressure due to greater urbanization, and recognition that cities should be considered as complex adaptive systems. According to Albrecht [6] urban development issues call for a holistic planning approach, where strategic spatial planning is 'Selective', rather than trying to solve all problems at once, it is 'Relational-Inclusive' with a focus on relations and processes while being inclusive of many stakeholders. Strategic spatial planning can be thought of as being 'Integrative' bridging vertical and horizontal integration between institutional processes. This outlook is based upon 'Visioning' with creative thinking about possible and desirable futures for a place; while finally strategic spatial planning being 'Action oriented' where

the focus is on implementation and getting things done. This emphasis on implementation prioritizes connections between various authorities, institutions, private organizations, community groups and individual citizens. However, many authors in this area acknowledge that the implementation of strategic spatial planning is undermined by a lack of political will, existing patterns of technocratic and hierarchical planning, and the inability of many actors (politicians, planners, community bodies, or private organizations, citizens etc.) to grasp or engage with alternative, more collaborative forms of planning [7, 8]. Likewise, Newman [9] was not surprised that strategic spatial planning has not taken hold to any significant degree. This alternative approach for planning demands "imaginative actors to help forge new forms of collective action" but such collective action, which seeks to bring government and civil society together, is frequently undermined as these actors often have contradictory views.

B. Framework for Interrogative City Infrastructures

Given the difficulties facing the implementation of strategic spatial planning and the need to bridge the perennial gap between top down and bottom up approaches as documented by others [10, 11, 12, 13, 14, 15], a Framework for Interrogative City Infrastructure is proposed based on the inter-relationship between hard and soft city infrastructures as illustrated in Figure 1. It represents city infrastructures as a matrix of soft and hard infrastructures within formal and informal settings that are ultimately intended to support livability and livelihood for people and communities living, working and visiting cities. These infrastructures do not represent actual conditions within a community. As such it is a framework that can be employed to examine the key support systems within a community that influence a range of social, environmental and economical urban issues such as mobility, quality of urban space, provision of community services etc.

In particular, the framework describes three hard city infrastructures as follows.

Utilities: Utilities are taken to refer to physical services such as transportation, water and waste systems, ICT, etc. These utilities connect and operate equally across all urban scales, including national and international interconnectivity.

Urban Space: Urban space is considered largely as bounded physical space, in the form of streets, urban plazas, or local squares, playgrounds parks etc. Urban space is typically identifiable at the neighborhood scale or district scale, depending on the nature of the open space.

Buildings: The Building Infrastructure refers largely to architectural space defined as single or grouped buildings forming part of an urban block. This will include dwellings, educational buildings, healthcare buildings etc.

By their nature soft city infrastructures are harder to define or map onto specific spatial scales. However, referring to previous work of Landry [16], Tonkiss [17], and Casey [18], three primary soft infrastructures can be defined as follows.

Institutional: Institutional infrastructures refer to public and private systems which provide certain services within the city such as local government, healthcare services, or educational services. It may also include sporting, art and culture, or official community support organizations. These institutions are typically top-down and more formal in nature.

Communal: Community infrastructures refer to informal networks or community groups that occur within neighborhoods or districts. These infrastructures rely on bridging and linking social capital. While 'Communities of Interest' or online communities may not be location specific, many community organizations will relate to a specific physical community delineated by political, parish or physical boundaries (a river, main street etc.). In this regard, community infrastructures will often operate at the district scale and arguably at a more identifiable level at the neighborhood scale.

Personal: Personal infrastructure refers to the support systems a person will have at an individual, family, or friendship level. It will often involve bonding social capital where membership of a family or social group is critical to a sense of belonging as well as educational attainment and other support systems that occur at an individual level.

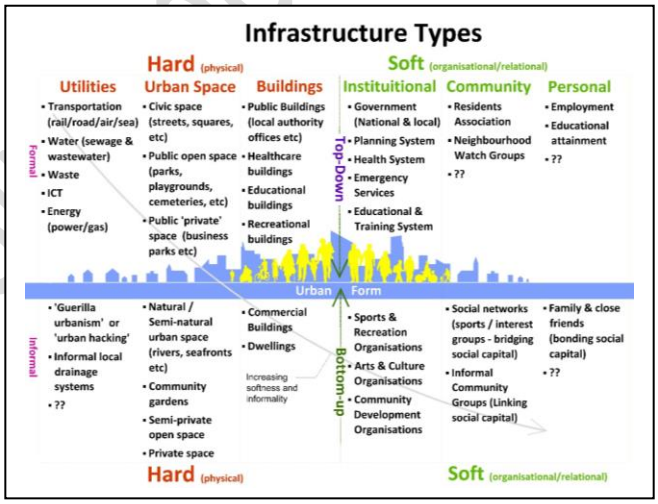

Figure 1 Framework for Interrogative City Infrastructures

One of the most significant characteristics of modern society is the ease, speed and inexpensive movement of people and information. The evolution of transport and ICT means that people can commute great distances or communicate and maintain personal, business, educational, or recreational relationships regardless of geographic location. In this context, the framework is seen as a starting point and there may be other infrastructures worth including. However, the six infrastructures outlined will characterize many issues within a community across social, environmental and economic domains. It is also important to recognize that these infrastructures can and will overlap and intertwine across the city and at different scales as illustrated in Figure 2.

In fact, the relationship between city infrastructure and spatial scale provides a valuable framework for understanding how different stakeholders might collect and map data in the urban environment. Furthermore, it helps structure how

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stakeholders might present and interpret data to support community participation and collaborative urbanism. For example, when collecting data from stakeholders, Moughtin et al. (2005) contend that public engagement is most effective at the city quarter, or neighbourhood level, as these represent a scale where residents can contribute their local knowledge and expertise. This is because neighbourhoods, quarters or districts of the city have a somewhat identifiable boundary, recognisable to both residents and outsiders alike. These neighbourhoods are structuring elements which are common to most cities and act on people's perception of the city, thus making the urban environment more intelligible and legible (Lynch, 1960). In addition, most people interact with the urban environment on a daily basis at the neighbourhood scale, which has a significant impact on their quality of life.

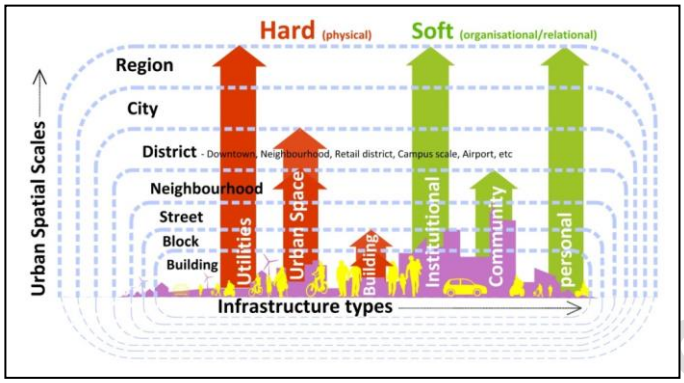

Figure 2 Sample Spatial Distribution of Interrogative City Infrastructures

As such the framework of Interrogative City Infrastructures provides a useful framework for collecting and mapping data within a community in relation to specific issues such as transport or housing. The Cities Infrastructures approach has the advantage of ensuring that no major component is being ignored in terms of data collection, analysis or proposed intervention. For example, a combination of local authority documentation and traditional street audits will reveal a great deal about hard infrastructure such as utilities or open space, but often little about community and personal infrastructures. As a consequence, alternative data gathering tools such as questionnaires or crowdsourcing community data can be collected to compare and contrast hard and soft infrastructures.

III. Case Stuy

The framework for City Infrastructures was tested at the Italian Renaissance city of Lucca in Tuscany. The study investigated the demise of the so-called PIUSS regeneration project for the former Toscana Cigar factory and the barriers to its progression. The PIUSS project was granted EU Structural Funds, 24 million, plus an additional 16 million euro to be provided from the region/province/city. The PIUSS project was expected to implement a number of interventions, both public and private urban developments aimed towards economic development. In particular, the PIUSS project was intended to address the following issues.

i. **Physical Infrastructure**. Parts of the city were in serious decline. For example only a few meters from World Heritage landscape, derelict areas exist that can't be accessed. Furthermore, the physical infrastructure of the historic city needed to be adjusted and upgraded for modern needs for example mobility, sanitation.

ii. **Institutional Infrastructure** Fragmented network of public agencies existed with several different agencies and institutions located outside the City/Region e.g. regulatory aspects of conservation sit under the Ministry of Culture in Rome.

iii. **Communal Infrastructure**. Up to 60 tour buses of tourist from Pisa and Florence visited the city on a daily basis. This very short-term relationship had limited benefit for both City and visitor. Longer-term residential stays needed to be promoted, relating tourism to urban identity.

iv. **Communal Infrastructure**. There was major differences between Lucca inside the walls and Lucca outside the walls. Understanding and successfully interfacing this relationship is a major challenge.

v. **Personal Infrastructure** There was a constant challenge to successfully communicate proposed change despite an extensive process of citizen engagement with some stakeholders remaining quiet during the consultation, yet making strong negative submissions late in the process.

To understand the demise of the PIUSS project, a field study was carried out over a two week period in September 2014. The study was undertaken by an inter-disciplinary team of architects, planners, public mangers, anthropologists, computer programmed and engineers. The exercise identified several barriers against citizen engagement along with several weakness to the long-term sustainability of the city. These are described as follows

i. Disconnections between the institutional and communal infrastructures due to an overly influential diaspora, catholic community represented by 100 churches, local mercantile community that effectively disenfranchised the local citizenship from decision making for PIUSS

ii. Disconnections between the physical infrastructures of the historic core and surrounding modern suburbs characterized by the presence of a massive intact historic city wall and green belt with limited physical access

iii. Disconnections between the communal infrastructures of historic core and surrounding modern separating characterized by dominant Airbnb tourist rental sector within the city walls together with a significant daily influx of tourist buses.

iv. Disconnections within the physical infrastructure for surrounding modern suburbs due to railway line bisecting the suburbs with a single bridge crossing

together with past destruction of a historical Roman aqueduct to accommodate a modern highway.

v. Disconnections between the commercial community and educational community where no tertiary educational institutional existed to promote education and research into the conservation of historical physical infrastructure that could upskill local population and support personal infrastructure

vi. Unwillingness to recognize the potential for district cooling from the underground network of caves beneath the historic city.

In essence, the field study found major disconnections between several forms of soft and hard city infrastructures that weakened urban governance and by their very nature presented significant obstacles to the successful implementation of the PIUSS project.

IV. DISCUSSION AND CONCLUSIONS

The PIUSS Project was driven by what would seem robust urbanistic values; creation of a good network of new public space to add to that already in Lucca, conservation and re-use of old buildings, the provision of new museum and exhibition space, the development of craft industries and the leveraging of the 'Comic Conference' and associated culture through developing graphic art skills. In a sense, this represented a creative search to animate the somewhat fossilized legacy of a hard infrastructure from the past and infuse it with contemporary vision. The PIUSS project can be seen therefore to be innovative and an interesting hybrid in the search to balance livelihood and livability.

One might ask why we need such hybrids for much loved historical towns like Lucca. It is true that Lucca captivates and enchants its visitors and many return to experience its urban qualities. Looking at the City however through the lens of Interrogative City Infrastructure provides an adjusted perspective. Imagining the Lucca of the past and applying the Infrastructural layers to a complex city across economic, social, cultural and physical/spatial spheres, we see an intense co-existence of commerce, religion, and art, making and colonizing a city both beautiful and practical, and inhabited by a population which lived within the City's protective walls. In the past, we could argue that Lucca's infrastructure, despite social inequality, was aligned with the needs of citizens, and this provided the basis for an acceptable balance [for its time] between livelihood and livability.

Then came the influence of the 20th Century, modern lifestyle, and the dominance of car culture. A new city was created outside the walls. While delivering more cost-effective and more generously scaled living spaces, modern offices and factories, and schools with good recreational facilities, it also pandered to the needs of the car and roads engineers. This weakened the sense of urban qualities, and resulted in a more fragmented spatial layout. It is ironic perhaps that a genuine and creative project to rejuvenate the Lucca within the Walls was rejected, while the car dominated lower-density and use-segregated Lucca outside the Walls remains largely uncontested. The reason of course is that the PIUSS was a high-profile project driven largely by a top-down vision, and although put together by a committed and multi-disciplinary team, failed to take ordinary citizens through a ' city-conversation' to agree together how the development could improve the urban 'Place' of Lucca.

ACKNOWLEDGMENT

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